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| 10/058,707 | 01/28/2002 | Atsushi Ueda | 10059-404US (P27007-01) | 7373 |
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| AKIN GUMP STRAUSS HAUER & FELD L.L.P. ONE COMMERCE SQUARE 2005 MARKET STREET, SUITE 2200 PHILADELPHIA, PA 19103 | | | ALEJANDRO, RAYMOND | |
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| | | | 1745 | |

DATE MAILED: 07/06/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/058,707

Applicant(s)

UEDA ET AL.

Examiner

Raymond Alejandro

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 June 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-6 and 8-15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 28 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 04/29/05.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 06/23/05 has been entered.

This office submission is in reply to the amendment in connection with the foregoing RCE. The applicants have overcome the main 35 USC 103 rejection. Refer to the aforesaid amendment for specific details on applicant's rebuttal arguments. However, the present claims are again rejected over newly discovered art as set forth hereinbelow and for the reasons of record:

Information Disclosure Statement

1. The information disclosure statement (IDS) submitted on 04/29/05 was considered by the examiner.

Double Patenting

2. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground

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provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

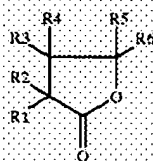
Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 1-7 are still rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-5 and 7-9 of U.S. Patent No. 6723473 in view of Takami et al 2003/0118913. Although the conflicting claims are not identical, they are not patentably distinct from each other because of the following reasons:

The '473 patent claims the following (claims 1-5 and 7-9):

1. A non-aqueous electrolyte secondary battery comprising a positive electrode, a negative electrode and a non-aqueous electrolyte where the non-aqueous electrolyte contains a solute and a non-aqueous solvent, and said non-aqueous solvent comprises a cyclic carboxylic acid ester and a cyclic carbonic acid ester having at least one carbon-carbon unsaturated bond.

2. A non-aqueous electrolyte secondary battery according to claim 1, wherein the cyclic carboxylic acid ester is at least one compound selected from the group consisting of γ -butyrolactone and its derivatives represented by the following formula (1):



(1)

(In the formula, R1 to R6 independently of one another are each hydrogen, halogen, an alkyl group of 1-6 carbon atoms or an acetyl group, and R4 and R5 may form a double bond together).

3. A non-aqueous electrolyte secondary battery according to claim 1, wherein the cyclic carbonic acid ester is at least one compound selected from the group consisting of vinylene carbonate, vinyl ethylene carbonate and derivatives thereof.

4. A non-aqueous electrolyte secondary battery according to claim 1, wherein the proportion of the cyclic carbonic acid ester is 0.5-20 vol % based on the cyclic carboxylic acid ester.

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5. A non-aqueous electrolyte secondary battery according to claim 1, wherein the electrolyte contains at least one cyclic carboxylic acid ester selected from the group consisting of γ -butyrolactone, γ -valerolactone and α -methyl- γ -butyrolactone and at least one cyclic carbonic acid ester selected from the group consisting of vinylene carbonate and vinylethylene carbonate, and the mixing proportion of the cyclic carbonic acid ester to the cyclic carboxylic acid ester is 0.5–20 vol %.

7. A non-aqueous electrolyte secondary battery according to claim 1, wherein the proportion of the cyclic carbonic acid ester is greater than or equal to 0.5 and less than 20 vol % based on the cyclic carboxylic acid ester.

8. A non-aqueous electrolyte secondary battery according to claim 1, wherein the electrolyte contains at least one cyclic carboxylic acid ester selected from the group consisting of γ -butyrolactone, γ -valerolactone and α -methyl- γ -butyrolactone and at least one cyclic carbonic acid ester selected from the group consisting of vinylene carbonate and vinylethylene carbonate, and the mixing proportion of the cyclic carbonic acid ester to the cyclic carboxylic acid ester is greater than or equal to 0.5 and less than 20 vol %.

9. A non-aqueous electrolyte according to claim 1, wherein said non-aqueous solvent consists essentially of a cyclic carboxylic acid ester and a cyclic carbonic acid ester having at least one carbon-carbon unsaturated bond.

In the '473 patent, the combination of claims 1 and 3-4 represents an obvious variation and/or modification of the subject matter claimed in the independent claim of the instant application. *Particularly, the subject matter of claim 5 recites “at least one cyclic carbonic acid ester selected from the group consisting of vinylene carbonate and vinylethylene carbonate”, thus, it is contended that the '473 patent fully encompasses more than one cyclic carbonic acid ester and specifically, the two claimed carbonates (i.e. vinylene carbonate and vinylethylene carbonate)*

The '473 patents claims a non-aqueous electrolyte secondary battery according to the aforementioned description. However, the '473 patent fails to expressly disclose the use of the cyclic carbonic acid ester having no carbon-carbon unsaturated bond.

Takami et al disclose a non-aqueous electrolyte secondary comprising an electrode group including a positive electrode, a negative electrode and a non-aqueous electrolyte including solvents and lithium salts dissolved therein (ABSTRACT). It is disclosed to use cyclic

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carbonates together with K-butyrolactone (BL) wherein the cyclic carbonates include ethylene carbonate (EC), propylene carbonate (PC) and vinylene carbonate (VC) (SECTION 0058-0059).

It is further disclosed that it is also desirable to prepare a mixed solvent by mixing BL with a third solvent such as PC, VC and an aromatic compound (SECTION 0059). Takami et al further disclose preferred combinations of the non-aqueous solvents including a combination of BL, EC, VC and methylethyl carbonate (MEC), a combination of BL, EC and VC, a combination of BL, PC and VC and a combination of BL, EC, PC and VC (SECTION 0061, 0174-0176).

In view of these disclosures, it would have been obvious to one skilled in the art at the time the invention was made to use the cyclic carbonic acid ester having no carbon-carbon unsaturated bond of Takami et al in the electrolyte solution of the battery of the '473 patent because Takami et al teach that it is desirable to use such cyclic carbonic acid ester solvent in combination with other known solvents because they all together permit improving the charge-discharge efficiency and cycle characteristics. In addition, Takami et al teach preferred combinations including a combination of BL, EC and VC, a combination of BL, PC and VC, and a combination of BL, EC, PC and VC.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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5. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

6. Claims 1-6, 8-9, 12-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of the publication WO 01/03228 (hereinafter referred to as "*the WO '228 publication*") and further in view of the Japanese publication JP 08-96852 (herein called "*the JP '852 publication*").

As to claims 1 and 5:

Takami et al disclose a non-aqueous electrolyte secondary comprising an electrode group including a positive electrode, a negative electrode and a non-aqueous electrolyte including solvents and lithium salts dissolved therein (ABSTRACT). It is disclosed to use cyclic carbonates together with K-butyrolactone (BL) wherein the cyclic carbonates include ethylene carbonate (EC), propylene carbonate (PC) and vinylene carbonate (VC) (SECTION 0058-0059). It is further disclosed that it is also desirable to prepare a mixed solvent by mixing BL with a third solvent such as PC, VC and an aromatic compound (SECTION 0059). Takami et al further disclose **preferred combinations** of the non-aqueous solvents including a combination of BL, EC, VC and methylethyl carbonate (MEC), a combination of BL, EC and VC, a combination of

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BL, PC and VC and a combination of BL, EC, PC and VC (SECTION 0061, 0174-0176)*(emphasis added).*

Takami et al further discloses the specific solvents containing γ -butyrolactone in a mixed solvent containing solvents such as (SECTION 0057-0059):

[0058] It is desirable to use a cyclic carbonate together with BL in the present invention because the cyclic carbonate permits improving the charge-discharge efficiency.

[0059] The cyclic carbonate used in the present invention includes, for example, propylene carbonate (PC), ethylene carbonate (EC), vinylene carbonate (VC), and trifluoropropylene carbonate (TFPC). Particularly, if EC is used together with BL, the charge-discharge characteristics and the large discharge characteristics can be markedly improved. It is also desirable to prepare a mixed solvent by mixing BL with at least one kind of a third solvent selected from the group consisting of PC, VC, TFPC, diethyl carbonate (DEC), methyl ethyl carbonate (MEC) and an aromatic compound. The mixed solvent of the particular construction permits improving the charge-discharge cycle characteristics.

Examples 15-18 show the following solvent combination (SECTION 0272-0275):

EXAMPLE 15

[0272] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 24% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 1% by volume of vinylene carbonate (VC).

EXAMPLE 16

[0273] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 23% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 2% by volume of vinylene carbonate (VC).

EXAMPLE 17

[0274] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 24.5% by volume of ethylene carbonate (EC), 75% by volume of γ -butyrolactone (BL) and 0.5% by volume of vinylene carbonate (VC).

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EXAMPLE 18

[0275] A thin nonaqueous electrolyte secondary battery was obtained as in Example 1, except that the nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 25% by volume of ethylene carbonate (EC), 74% by volume of γ -butyrolactone (BL) and 1% by volume of toluene.

As for claims 2-3:

Takami et al disclose the specific use of γ -butyrolactone (BL) (SECTION 0057-0059).

Regarding claims 4 and 6-9:

As seen above, Takami et al disclose the use of mixed solvents such as vinylene carbonate (VC), propylene carbonate (PC), ethylene carbonate (EC), γ -butyrolactone (BL) and methyl ethyl carbonate (MEC) and diethyl carbonate (DEC) (Sections 0059, 0061, 0174-0176).

[0061] Preferred combinations of the nonaqueous solvents used in the present invention include, for example, a combination of BL and EC, a combination of BL and PC, a combination of BL, EC and DEC, a combination of BL, EC and MEC, a combination of BL, EC, MEC and VC, a combination of BL, EC and VC, a combination of BL, PC and VC, and a combination of BL, EC, PC and VC. In this case, it is desirable to set the mixing ratio of EC to fall within a range of between 5 and 40% by volume. It should be noted

As to claims 12-13:

Takami et al disclose that as positive and negative electrode material the following compounds can be used (SECTION 0029):

[0029] Examples of the positive electrode active material are various oxides such as manganese dioxide, lithium manganese composite oxide, lithium-containing nickel oxide, lithium-containing cobalt oxide, lithium-containing nickel cobalt oxide, lithium-containing iron oxide, and lithium-containing vanadium oxide, and chalcogen compounds such as titanium disulfide and molybdenum disulfide. Of these materials, lithium-containing cobalt oxide (e.g., LiCoO_2), lithium-containing nickel cobalt oxide (e.g., $\text{LiNi}_{0.8}\text{Co}_{0.2}\text{O}_2$), and lithium manganese composite oxide (e.g., LiMn_2O_4 and LiMnO_2) are preferably used because high voltage can be obtained.

As negative electrode material graphite can be used (SECTION 0038).

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As to claims 14 (see also specific rejection of claims 14 below):

Takami et al teaches the employment of lithium salts being LiPF_6 and LiBF_4 the most preferred (SECTION 0064):

[0064] Examples of the electrolytic salt contained in the nonaqueous electrolyte are lithium salts such as lithium perchlorate (LiClO_4), lithium hexafluoride (LiPF_6), lithium borofluoride (LiBF_4), lithium arsenic hexafluoride (LiAsF_6), lithium trifluoromethanesulfonate (LiCF_3SO_3), and bistrifluoromethylsulfonilimide lithium [$\text{LiN}(\text{CF}_3\text{SO}_2)_2$]. Of these lithium salts, LiPF_6 and LiBF_4 are most preferred.

As to claim 15:

Takami et al further disclose the following with respect to the solvent comprising a benzene-like or derivative compound such as benzene, toluene, xylene, biphenyl and terphenyl (SECTION 0063):

[0063] It is possible to use a nonaqueous solvent containing BL in an amount larger than 50% by volume and not larger than 95% by volume, EC and an aromatic compound in place of the mixed nonaqueous solvent of the composition described previously. The aromatic compound is at least one compound selected from the group consisting of benzene, toluene, xylene, biphenyl and terphenyl. EC is deposited on

Example 41 shows the specific solvent mixing solution:

EXAMPLE 41

[0312] A thin nonaqueous electrolyte secondary battery was obtained as in Example 26, except that a nonaqueous electrolyte used was prepared by dissolving 1.5 mol/l of LiBF_4 in a mixed nonaqueous solvent consisting of 25% by volume of ethylene carbonate (EC), 74% by volume of γ -butyrolactone, and 1% by volume of toluene.

Takami et al disclose a non-aqueous electrolyte secondary battery according to the foregoing. However, Takami et al do not disclose the specific use of vinyl ethylene carbonate solvent and its volume percent.

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The WO'228 publication discloses a non-aqueous electrolyte secondary cell wherein an electrolyte comprises a cyclic carboxylic acid ester as a non-aqueous solvent and further comprises a cyclic carbonic acid ester having at least one carbon-carbon unsaturated bond (ABSTRACT). In particular, the WO'228 publication discloses the specific use of vinylethylene carbonate and derivatives thereof (page 5, line 25 to page 6, line 50). It is also disclosed that the content of the cyclic carbonic acid esters is preferably 0.5-20 vol. % (page 6, lines 5-7). It is further disclosed that the addition of other esters is not excluded (*←emphasis added*) (page 6, lines 8-13). **Examples 18-22** shows the specific use of VEC added to the cyclic carboxylic acid ester.

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the vinylethylene carbonate solvent and its volume percent of the WO'228 publication in the battery of Takami et al as the WO'228 publication discloses that such solvent addition provides a non-aqueous electrolyte secondary cell exhibiting a high electrical conductivity under low temperature circumstances and suppressed reduction decomposition. In this case, it is further noted that the WO'228 publication directly teaches the use of the specific solvent within the claimed volume range. *Furthermore, it is noted that the WO'228 publication and Takami et al share the same field of applicant's endeavor of providing suitable non-aqueous electrolytic solutions for electrochemical applications or resistance to electrochemical oxidation/reduction. Thus, both references are relevant to each other. Moreover, since Takami et al directly teach the use of cyclic carbonic acid esters having at least one carbon-carbon unsaturated bond in a combination of mixed solvents, a cyclic carbonic acid esters can be*

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interchangeably used to substitute another cyclic carbonic acid esters because they are deemed to be functionally and chemically equivalent.

In addition, none of the preceding prior art expressly discloses combining vinylene carbonate with other solvents.

The JP'852 publication discloses a non-aqueous electrolytic secondary battery having a non-aqueous electrolytic solution containing an electrolyte dissolved in a solvent wherein vinylene carbonate (VC) is used in an amount of at least 20 vol. % (ABSTRACT). Specifically, the JP'852 publication teaches that VC can be used singly or in combination, for example, ethylene carbonate and γ -butyrolactone or other solvents can be used therefor (paragraph 0024-0025).

In view of the above, it would have been obvious to a one of skill in the art at the time the invention was made to combine vinylene carbonate of the JP'852 publication with other solvents of the both Takami et al and Mita et al as the JP'852 publication discloses that by using an electrolytic solution material containing vinylene carbonate, a secondary battery exhibiting high energy density and good cycle characteristic is obtained. Furthermore, because VC is not decomposed by graphite, it is possible to use graphite having a high true density as a negative electrode active material, whereby the energy density of the battery can be improved; and since VC has a freezing point below certain temperature, good cycle characteristics can be further achieved in lower temperature environment. *In light of aforementioned, the JP'852 publication is found pertinent to Takami et al and Mita et al and within the field of applicant's endeavor as the JP'852 publication is strictly directed to non-aqueous electrolyte solvent using vinylene carbonate as a solvent and in combination with multiple additional solvents. Thus, those of*

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ordinary skill in the art would obviously recognize the chemical interchangeability of these solvents.

7. Claims 10-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of the publication WO 01/03228 (hereinafter referred to as "*the WO '228 publication*") and further in view of the Japanese publication JP 08-96852 (herein called "*the JP '852 publication*") as applied to claim 1 above, and further in view of the European document EP 0796510.

Takami et al, the WO'228 publication and the JP'852 publication are applied, argued and incorporated herein for the reasons above. However, the preceding references do not disclose the solvent comprising a glime.

The EP'510 document discloses a non-aqueous electrolyte system consisting of a solvent mixture containing ethylene carbonate, g-valerolactone and optionally containing one or more additional solvents selected from other organic carbonates as glymes (SECTION 0010-0011/ CLAIM 1).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the solvent comprising a glime of the EP'510 document in the solvent mixture of Takami et al, the WO'228 publication and the JP'852 publication as the EP'510 document teaches that a mixture of solvents comprising glyme can be used in electrolyte systems for batteries as they can be applied in a broad voltage range, which has a conductivity higher than conventional conductivities at room temperature, and which shows a high stability against reduction.

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8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of the publication WO 01/03228 (hereinafter referred to as "*the WO'228 publication*") and further in view of the Japanese publication JP 08-96852 (herein called "*the JP'852 publication*") as applied to claim 1 above, and further in view of Kida et al US 2001/0018152.

Takami et al, the WO'228 publication and the JP'852 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not disclose the specific molar ratio of both lithium salts.

Kida et al disclose a lithium secondary battery (TITLE) wherein it has been reported that the charge-discharge cycle performance can be improved by using both LiPF₆ and LiBF₄ as the electrolytic salt of the nonaqueous electrolyte in a lithium secondary battery (SECTION 0006).

Kida et al disclose a specific example using a mixture including LiPF₆ and LiBF₄ in a molar ratio of 4:1 (SECTION 0032/ TABLE 1-BATTERY X6).

[0006] For example, it has been reported that the charge-discharge cycle performance can be improved by using both LiPF₆ and LiBF₄ as the electrolytic salt of the nonaqueous electrolyte in a lithium secondary battery using Li_xMO₂.

COMPARATIVE EXAMPLES 1 THROUGH 6

[0032] Comparative batteries X1 through X6 were fabricated in the same manner as in Embodiment 1 except that 1.0 mol/liter of LiB(C₆F₅)₄ dissolved in the preparation of the nonaqueous electrolyte was replaced with 1.0 mol/liter of LiPF₆, LiBF₄, LiCF₃SO₃, LiN(CF₃SO₂)₂, LiN(C₂F₅SO₂)₂, or a mixture including LiPF₆ and LiBF₄ in a molar ratio of 4:1.

X6 0.8 M LiPF₆ + 0.2 M LiBF₄ 73

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific molar ratio of both lithium salts of Kida et al in the electrolyte-solvent mixture of both Takami et al, the WO'228 publication and the JP'852

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publication as Kida et al teach that it has been reported that the charge discharge cycle performance can be improved by using both LiPF_6 and LiBF_4 as the electrolytic salt of the nonaqueous electrolyte in a lithium secondary battery (SECTION 0006) as well as the capacity retention ratio is improved (SECTION 0034). Thus, it provides a lithium secondary battery exhibiting better charge-discharge cycle performance than a lithium using a conventional single non-aqueous electrolyte.

9. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of the publication WO 01/03228 (hereinafter referred to as "*the WO'228 publication*") and further in view of the Japanese publication JP 08-96852 (herein called "*the JP'852 publication*") as applied to claim 1 above, and further in view of Inoue et al 6090506.

Takami et al, the WO'228 publication and the JP'852 publication are applied, argued and incorporated herein for the reasons above. However, the preceding prior art does not disclose the specific molar ratio of both lithium salts.

Inoue et al divulges a non-aqueous secondary battery wherein the electrolyte to be contained in the battery comprises one or more lithium salts soluble therein, particularly preferred, an electrolytic solution comprising LiBF_4 and LiPF_6 incorporated in a mixture of organic solvents (COL 12, lines 12-35). **EXAMPLE 1** shows the use of an electrolyte comprising LiPF_6 and LiBF_4 in an amount of 0.9 mol and 0.1 mol per L, respectively (COL 17, lines 12-20 or EXAMPLE 1).

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propanesultone and one or more lithium salts soluble
25 therein, such as LiClO_4 , LiBF_4 , LiPF_6 , LiCF_3SO_3 ,
 LiCF_3CO_2 , LiAsF_6 , LiSbF_6 , $\text{LiB}_{10}\text{Cl}_{10}$, lower aliphatic
lithium carboxylate, LiAlCl_4 , LiCl , LiBr , LiI , chloroboran
lithium and lithium tetraphenylborate. In particular, an elec-
trolytic solution comprising LiCF_3SO_3 , LiClO_4 , LiBF_4 and/
30 or LiPF_6 incorporated in a mixture of propylene carbonate or
ethylene carbonate and 1,2-dimethoxyethane and/or diethyl
carbonate is preferred. Further, an electrolytic solution com-
prising LiBF_4 and/or LiPF_6 incorporated in a mixture of
ethylene carbonate and/or diethyl carbonate is particularly
35 preferred.

iron closed-end cylindrical battery case (11). Into the battery
case was then poured an electrolyte comprising LiPF_6 and
 LiBF_4 dissolved in a 2:4:3:1 (by volume) mixture of ethyl- 15
ene carbonate, dimethyl carbonate, diethyl carbonate and
ethyl propionate in an amount of 0.9 mol and 0.1 mol per l,
respectively. The edge of the battery can was then crimped

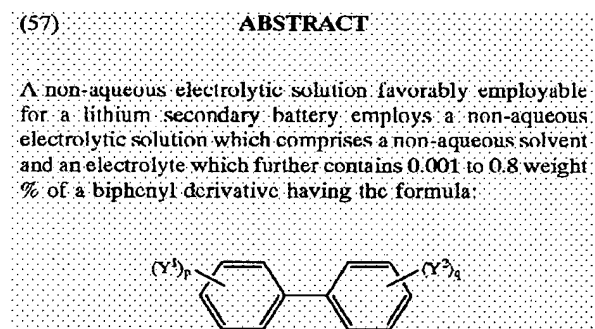
In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the specific molar ratio of both lithium salts of Inoue et al in the electrolyte-solvent mixture of Takami et al, the WO'228 publication and the JP'852 publication as Inoue et al teach an electrolytic solution comprising LiBF_4 and LiPF_6 incorporated in a mixture of organic solvents is particularly preferred because it has been determined that such amount of electrolyte incorporated into a battery improves the discharge-charge characteristic of the battery. In addition, it has been generally-conventionally reported that the charge discharge cycle performance can be improved by using both LiPF_6 and LiBF_4 as the electrolytic salt of the nonaqueous electrolyte in a lithium secondary battery (SECTION 0006) as well as the capacity retention ratio is improved (SECTION 0034). Thus, it provides a lithium secondary battery exhibiting better charge-discharge cycle performance than a lithium using a conventional single non-aqueous electrolyte.

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10. Claim 15 is rejected again under 35 U.S.C. 103(a) as being unpatentable over Takami et al US 2003/0118913 in view of the publication WO 01/03228 (hereinafter referred to as "*the WO '228 publication*") and further in view of the Japanese publication JP 08-96852 (herein called "*the JP '852 publication*") as applied to claim 1 above, and further in view of Hamamoto et al US 2002/0001756.

Takami et al, the WO'228 publication and the JP'852 publication are applied, argued and incorporated herein for the reasons above. However, Takami et al and Mita et al do not disclose the solvent comprising a derivative of benzene.

Hamamoto et al disclose the following (ABSTRACT):



In particular, Hamamoto et al teach the use of biphenyl derivatives and a cyclic compound group (SECTIONS 0016).

In view of the above, it would have been obvious to one skilled in the art at the time the invention was made to use the solvent comprising a derivative of benzene of Hamamoto et al in the solvent mixture of Takami et al, the WO'228 publication and the JP'852 publication as Hamamoto et al teach that by using the benzene derivative as a solvent, a non-aqueous electrolytic solution which is favorably employable for a lithium secondary battery and which

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shows high battery performance such as high electric capacity and high cycling performance under maximum operation voltage condition or elevated temperature is obtained.

Response to Arguments

11. Applicant's arguments with respect to claims 1-6 and 8-15 have been considered but are moot in view of the new ground(s) of rejection.

12. In addition, applicant's declaration dated 06/23/05 has been reviewed in its entirety.

With particular respect to the foregoing declaration, the examiner likes to point that although the results shown therein appear to demonstrate a reduction in the amount of gas generated after the cycles, those results are not fully commensurate in scope with the presently claimed content of the cyclic carbonic acid ester. Succinctly stated, the secondary evidence of unexpected results does not encompass the entire claimed range of 0.5 to 20 volume percent thereof. As apparent from Table 1-2 (Refer to the Declaration of 06/23/05), unexpected results for the gas generating characteristics of the battery is achieved when the combined volume percent of both cyclic carbonic acid ester is 3 vol % only. That is to say, said declaration has provided no further evidence that superior characteristics are also unexpected for the claimed ranges including 0.5-2.9 vol % and 3.1 to 20 vol % (**←emphasis added**). Accordingly, the unexpected results based upon the experimental data presented in the declaration does not validate the superior performance attributed to the combination of the both cyclic carbonic acid ester carbonate solvents to the full extent instantly claimed by the applicant.

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(In the event that applicants further present previous arguments and/or come forward with the unexpected result arguments presented prior to this office action)

1. With respect to unexpected results based on the results presented in the second declaration of 11/08/04, the examiner points out that the foregoing performance characteristic of the exemplified battery does not reflect or correspond to the performance characteristic of the claimed non-aqueous electrolyte battery because the objective evidence of nonobviousness is not commensurate in scope with the instant claims which the evidence is offered to support. For instance, it is noted that Battery (d) supposedly showing an effective increase in the initial charge/discharge efficiency (%) does not evidence unexpected results for the entire claimed range of 0.5 to 20 volume percent of VEC inclusive (i.e. 0.5 VEC (vol %) 20) as instantly claimed in the present claims because as apparent from the experimental data related to Battery (d), effective increase in the initial charge/discharge efficiency (%) is obtained by only adding 5 % volume of VEC solvent. For that reason, it is contended that the objective evidence of nonobviousness is not commensurate in scope with the present claims. Given that the new ground of rejection now includes the combined use of at least: a) the cyclic carboxylic acid ester and b) the cyclic carbonic acid ester, and c) does not exclude other carbonic acid ester solvents, it is still believed that this case of obviousness is nevertheless stronger than the secondary consideration presented by the applicants (i.e. the unexpected results associated with the declaration of 11/08/04).

Incidentally, it is further contended that the submission of objective evidence of patentability does not automatically mandate a conclusion of patentability in and of itself. Although the record may establish evidence of secondary considerations which might be indicia

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of nonobviousness, the actual record establishes such a strong case of obviousness that the objective evidence of nonobviousness is not sufficient to outweigh the evidence of obviousness. Accordingly, a prima facie case of obviousness cannot be simply rebutted by merely recognizing additional advantages or latent properties present in the prior art. Additionally, applicant is further reminded that an allegation of unexpected results must be in the form of a direct or indirect comparison of the claimed invention with the closest prior art (*i.e. the new ground of rejection*) which is commensurate in scope with the claims (*See MPEP 716.02(b) Burden on Applicant*). Therefore, such applicant's arguments have been considered but are also moot in view of the new ground(s) of rejection.

2. (*In the event that applicants further come forward with the unexpected result arguments presented prior to this office action*) With respect to applicants' arguments presented in the amendment of 06/17/04 stating that EXAMPLE 6 and TABLES 12-13 show unexpected results (thereby demonstrating that there is a difference in the amount of gas generated), the examiner likes to point out that the foregoing performance characteristic of the exemplified battery does not reflect or correspond to the performance characteristic of the claimed non-aqueous electrolyte battery because the objective evidence of nonobviousness is not commensurate in scope with the instant claims which the evidence is offered to support. For instance, it is noted that data of EXAMPLES 6 and TABLES 12-13 showing an effective reduction in the amount of gas generated after the battery cycles does not evidence unexpected results for the entire claimed range of 1-99 vol %, inclusive (*i.e.* 0 VEC vol % - 100) as implicitly claimed in the present claims because as apparent from EXAMPLES 6 and TABLES 12-13, significant reduction in the amount of generated gas is achieved by specifically using the VEC solvent at a 1 vol % only

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[not for the entire claimed range of 1-99 vol %, inclusive (i.e. 0 VEC vol % 100) as implicitly claimed in the present claims]. For that reason, it is contended that the objective evidence of nonobviousness is not commensurate in scope with the present claims.

3. Regarding the unexpected results based on the results presented in applicant's declaration submitted on 06/17/04, which exhibits superior capacity maintenance rates, cycle lives and small amounts of gas generated after the cycles, the examiner also contends that the foregoing performance characteristic of the exemplified batteries does not reflect or correspond to the performance characteristic of the claimed non-aqueous electrolyte secondary battery because the objective evidence of nonobviousness is not commensurate in scope with the instant claims which the evidence is offered to support. For instance, it is noted that the tabulated data of paragraph 14 (see the declaration of 06/17/04) showing improved capacity maintenance rate, cycle life and reduction in the amount of generated gas does not evidence unexpected results for the entire claimed molar ratio of 1:9 to 9:1 because as apparent from such tabulated data results:

a) no significant or statistically difference is exhibited with respect to the capacity maintenance rate, that is, for the claimed molar ratio of 1:9 to 9:1 the capacity maintenance rate after storage (%) ranges from 82-84 while for the unclaimed range the capacity maintenance rate after storage (%) exhibits percents of 81 % and 84 %. Thus, it is asserted that no significant difference and/or superior results have been obtained for the capacity maintenance rate characteristic because the difference between the capacity maintenance characteristic rate of Batteries 1F/(a)/(b)/5F and Batteries 2F/3F/4F is equal to or less than 1 % , including no difference at all between Battery 2F and Battery (a); accordingly, there is no unexpected results

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or superior characteristics *at all* between the instantly claimed molar ratio and the unclaimed molar ratio;

b) as to the cycle life, as shown in the tabulated data, no expected results were obtained at least for the claimed molar ratio $\text{LiPF}_6/\text{LiBF}_4$ of 1:9 because the cycle life of the foregoing molar ratio (*cycle life: 450*) is even lower than the cycle molar ratios $\text{LiPF}_6/\text{LiBF}_4$ of 0.05/0.95 (*cycle life: 470*) and 0/1 (*cycle life: 500*); hence, it is concluded that the entire claimed molar ratio is not critical because no unexpected results or superior characteristics have been positively identified for the entire claimed range of 1:9 to 9:1;

c) with reference to the gas amount after cycles (mL), superior results appear to be obtained only at the claimed molar ratio of 9/1 as the gas amount of the remaining claimed molar ratio ranging from 1/1 to 1/9 (*gas amount: 2.2 mL and 2.5 mL, respectively*) is either equal to or even lower than the gas amount of the unclaimed molar ratio of 1/0 and 0.95/0.05 (*gas amount: 2.3 mL and 2.2 mL, respectively*); therefore, it is also concluded that the entire claimed molar ratio is not critical because unexpected results or superior characteristics were not found for the entire claimed range of 1:9 to 9:1.

For that reason, it is contended that the objective evidence of nonobviousness is not commensurate in scope with the present claims.

In addition, as to the superior performance characteristics of the results presented in applicant's declaration filed 06/17/04 which exhibits superior capacity maintenance rates, cycle lives and small amounts of gas generated after the cycles, the examiner further states that such results and, thus, the specific battery as set forth in the tabulated data of paragraph 14 are not commensurate to the specific non-aqueous electrolyte battery as claimed in claim 14. In this

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respect, it is emphasized that the claimed non-aqueous electrolyte battery includes the use of VEC as a solvent while the experiment of the declaration were performed in the absence of VEC solvent, thus, the batteries of the declaration lack, at least, one significant, essential, vital and/or crucial feature, for instance, the specific VEC solvent. Thus, the foregoing performance characteristics of the exemplified declaration's batteries do not reflect or correspond to the performance characteristic of the claimed non-aqueous electrolyte battery as instantly claimed in claim 14.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Raymond Alejandro whose telephone number is (571) 272-1282. The examiner can normally be reached on Monday-Thursday (8:00 am - 6:30 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick J. Ryan can be reached on (571) 272-1292. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Raymond Alejandro



RAYMOND ALEJANDRO
PRIMARY EXAMINER

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Primary Examiner
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RAYMOND ALEJANDRO
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